

CLIMATE ACTION & ADAPTATION PLAN

DRAFT – April 22, 2019

In addition to this PDF report, these items are intended to be housed online in a user-friendly format.

Introduction

Columbia's Climate Action and Adaptation Plan (CAAP) lays out a vision and strategy to address risks posed by climate change and to contribute to international efforts to draw down greenhouse gas (GHG) emissions. Cities are poised to lead climate change efforts. Collectively, the world's cities are responsible for 70 percent of greenhouse gas emissions.¹ Cities are also at the frontlines of bearing climate change impacts, such as urban heat island, flooding, drought, and risks to optimal public health. With this plan, Columbia is joining a global coalition of cities committed to reducing these climate change impacts.

The effects of increased global greenhouse gas emissions threaten Columbia's resources and quality of life. Extreme heat, drought, higher incidence of extreme severe storms, and reduced air quality are growing threats in Columbia due to climate change. By taking action now to reduce our community's contribution to worldwide emissions and prepare for climate risks, the City of Columbia can better protect the wellbeing of its residents for decades to come. The purpose of this plan is twofold:

1. To prepare Columbia's natural and built environments (its neighborhoods, resources, and systems) and people to be more resilient to the impacts of climate change; and
2. To reduce greenhouse gas emissions community-wide through targeted municipal, residential, industrial and commercial activities.

The plan was written for the community and by the community. Significant contributors included the public, the Mayor's Task Force on Climate Action & Adaptation Planning (Task Force), and City staff. In development since 2017 through a process that included multiple community and City of Columbia Staff workshops, Task Force meetings, and a public survey, this plan focuses on *effective* actions. These actions achieve the greatest emission reductions and increase our community preparedness in the most cost-effective and equitable manner. The entire community—businesses, residents, and municipal government—all have a role in both implementing the plan and enjoying its benefits.

¹ "Hot Cities: Battle-Ground For Climate Change." UN Habitat. 2011. http://mirror.unhabitat.org/downloads/docs/E_Hot_Cities.pdf

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Executive Summary

The effects of increasing global greenhouse gas emissions threaten Columbia's resources and the quality of life for Columbia's residents. Columbia's Climate Action and Adaptation Plan (CAAP) lays out a vision and strategy to address risks posed by climate change and contributes to international efforts to reduce greenhouse gas emissions. The **purpose of this plan** is twofold:

1. To prepare Columbia's natural and built environments (its neighborhoods, resources, and systems) and people to be more resilient to the impacts of a changing climate; and
2. To reduce greenhouse gas emissions community-wide through targeted municipal, residential, industrial and commercial activities.

Developed over a year-long engagement process with the public, the Mayor's Task Force on Climate Action & Adaptation Planning, and City staff, the plan focuses on activities that achieve the greatest emission reductions or do the most to increase our community preparedness in the most cost-effective and equitable manner.

Columbia's vision is to be the best place for everyone to live, work, learn and play.

The plan sets specific greenhouse gas **emissions reduction targets**. The City's "80x50" target—an 80% reduction in greenhouse gas emissions by 2050—is broadly accepted by cities, states, and nations and prepares the city for carbon neutrality by 2060. The 80x50 target aligns with the Paris Agreement and scientific understanding of the reductions necessary to avoid catastrophic risks of climate change associated with 2.0°C increase in average global temperature.²

- **Community-wide Target:** Reduce GHG emissions by 35% below 2015 baseline by 2035, 80% by 2050 and 100% by 2060.
- **Municipal Operations Target:** Reduce GHG emissions associated with City operations by 50% below 2015 baseline by 2035 and 100% by 2050.

To achieve this ambitious emissions reduction goal—and to adapt to climate change—this plan includes sector-specific goals, strategies, and actions. Successful implementation of these strategies and actions will require continued cooperation and commitment across the community, including from the public sector, private sector, residents, and businesses. A summary of key strategies in each sector is provided below.

² The City considered using 2010 as a baseline year for consistency with the Intergovernmental Panel on Climate Change (IPCC) Special Report findings, but decided to use 2015 due to data inconsistencies in the 2010 GHG inventory.

Sector-Specific Strategies

Energy

- Increase on-site renewable energy installations in new and existing buildings.
- Maximize Columbia Water and Light's renewable energy purchasing and production.
- Create a resilient energy grid.
- Manage energy demand to reduce peak energy use.

Transportation

- Prioritize safety and convenience of walking, biking, and riding transit.
- Shift land use patterns to shorten trips and reduce the need to drive.
- Encourage use of low- to zero-emissions vehicles.
- Improve efficiency of vehicle traffic.

Waste

- Encourage reuse.
- Expand composting participation and operation.
- Divert construction and demolition waste.
- Require and incentivize recycling.
- Upgrade solid waste facilities.
- Track waste diversion.

Housing, Building, and Development

- Increase energy efficiency in residential, commercial, and municipal buildings.
- Decrease the impact of building stock on local air pollution and greenhouse gas emissions.
- Support development of buildings that are resilient to anticipated future conditions.

Natural Resources

- Increase climate resilience and carbon sequestration potential public and private lands.
- Reduce per capita water usage.
- Reduce negative impacts from stormwater runoff and flooding.

Health, Safety, and Wellbeing

- Reduce incidences of heat-related illness and death.
- Prevent and prepare for increased incidence of vector-borne disease.
- Increase production of local food.
- Assure food security, particularly among the most vulnerable populations.

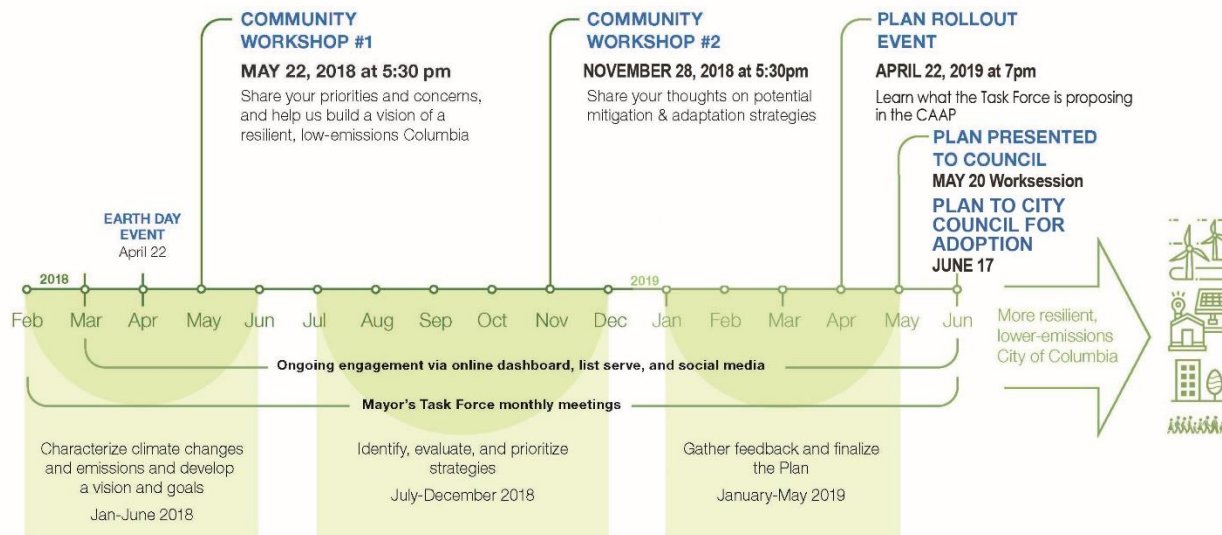
The plan also contains an **implementation strategy** that outlines protocols and templates for plan implementation, monitoring, and evaluation. An appendix to the final plan will include a detailed actions list with associated timeframes, responsible parties, and next steps, as well as a list of key performance indicators for tracking progress, templates for reporting on indicator and action progress, and internal protocols for City implementation.

To be successful, the Columbia Climate Action and Adaptation Plan must be an iterative process. This plan has set goals, strategies and actions. As it is implemented, staff and community will continually evaluate the key performance indicators, calculate environmental and financial impacts, and then revise the goals, strategies and actions, as required. Outreach, engagement and education will be required throughout this process to succeed.

Plan Development and Objectives

Plan Development Process

This plan is the product of over a year-long public and stakeholder engagement process that included three community workshops, an online public survey, presentations at board and commission meetings, engagement at community events, collaboration with concurrent planning efforts, and close collaboration with a Mayor-appointed Task Force.



The community workshops provided the public with an opportunity to learn about the planning process, provide feedback on the plan's vision and strategies, and discuss priorities, challenges, and solutions with the project team and other community members. The online public survey gathered input on issues, ideas, and potential mitigation and adaptation options.

The City of Columbia engages in multiple planning processes in the normal course of business. Concurrent to the Climate Action & Adaptation Plan process, community input was and will continue to be reviewed from the following efforts:

- City of Columbia Strategic Plan
- City of Columbia Vision Zero Plan
- Community Development Consolidated Plan
- Columbia Utilities Integrated Management Plan
- Columbia Utilities Integrated Electric Resource and Master Plan
- CATSO Long Range Transportation Plan
- Columbia / Boone County Public Health & Human Services Community Health Improvement Plan

The project management team for this plan has incorporated feedback from public and stakeholder engagement processes into this plan. This reflection respects the conversations our neighbors are having on what makes Columbia the best place to live, work, learn, and play—and what opportunities for improvement exist to achieve this vision.

Columbia's Voice: Results from the Community Survey

In November 2018, over 900 people responded to an online community survey for the Climate Action and Adaptation Plan. Responses from the survey indicate:

- Strong community support for **immediate action** to reduce greenhouse gas emissions from energy use and land use and prepare for a changing climate.
- Strong agreement that Columbia should be a **leader** when it comes to proactively addressing climate change.
- The top **actions** for addressing climate change include:
 - Designing streets and traffic controls to lower vehicle emissions and support walkability.
 - Replacing the City's vehicle fleet with hybrid and electric vehicles.
 - Offering incentives for energy and water efficiency, solar readiness, and stormwater management that go beyond code.
 - Requiring recycling at multi-family residences.
 - Investing in innovative technologies to enhance renewable energy usage (e.g., energy storage, combined heat and power, microgrids).
 - Aligning the municipal utilities' strategic plans help the community meet climate action objectives.
 - Requiring landlords to manage and mitigate mold and fungus in rental units.
 - Increasing native tree cover on public and private property.
- Preferred **funding strategies** include paying fees associated with specific services, programs, or activities and reprioritizing existing resources to pay for climate action.



Climate and Equity

It is very important that the CAAP is developed and implemented through an equity lens. Each CAAP action should be implemented in a manner that promotes equity and mitigates structural racism and historic inequality. Providing equitable access to climate action and adaptation benefits requires meeting community needs and implementing measures that address existing vulnerabilities and inequalities. The CAAP will also consider where climate action strategies may lead to adverse, unintended impacts. For example, improving bike lanes and adding open space could spur gentrification and displacement. Similarly, additional City fees and rate increases could add new burdens to low- and fixed-income communities.

Ways to ensure that equity is considered throughout the CAAP implementation process include:

- Designing policies and programs that serve disadvantaged communities first.
- Focusing policies and programs on communities experiencing high pollution burdens, poverty, health issues, and exposure to climate hazards.
- Using an “equity checklist” when implementing actions. See the example list below.
- Proactively engaging community leaders and members on an ongoing basis.

Below are key equity considerations and questions, drawn from the City of Portland’s Climate Action Plan, to consider before implementing climate actions:

- **Disproportionate impacts** - Does the proposed action generate burdens (including costs), either directly or indirectly, to communities of color or low-income populations? If yes, are there opportunities to mitigate these impacts?
- **Shared benefits** - Can the benefits of the proposed action be targeted in progressive ways to reduce historical or current disparities? Are the benefits dispersed not only equally, but equitably?
- **Accessibility** - Are the benefits of the proposed action broadly accessible to households and businesses throughout the community - particularly communities of color, low-income populations, and minority, women and emerging small businesses?
- **Engagement** - Does the proposed action engage and empower communities of color and low-income populations in a meaningful, authentic, and culturally appropriate manner? Are community stakeholders involved and engaged in implementation?
- **Capacity** - Does the proposed action help build community capacity through funding, an expanded knowledge base or other resources?
- **Alignment and partnership** - Does the proposed action align with and support existing communities of color and low-income population priorities, creating an opportunity to leverage resources and build collaborative partnerships?
- **Relationship building** - Does the proposed action help foster the building of effective, long-term relationships and trust between diverse communities and local government?
- **Economic opportunity and staff diversity** - Does the proposed action support communities of color and low-income populations through workforce development, contracting opportunities or the increased diversity of city and county staff? Does it engage leaders in those communities?
- **Accountability** - Does the proposed action have appropriate accountability mechanisms to ensure that communities of color, low-income populations, or other vulnerable communities will equitably benefit and not be disproportionately harmed?

Ensuring that participation in climate action is accessible to the entire Columbia community will require considering equity in policy, outreach, and infrastructure development. City staff will work to involve diverse community voices from the start of any new initiative and will track progress towards advancing equity.

Equity Actions in the Plan

While equity will need to be considered in implementing every strategy and action within this plan, there are particular actions for which equity considerations will be critical, such as:

I-2.1.4	Develop a process for requiring mitigation, adaptation and climate-equity impact assessments for all new policies and projects that meet threshold criteria, such as cost burden, vulnerability, or increase to net emissions.
I-3.2.1	Create a report that identifies the differential impact of climate change on neighborhoods and communities.
I-3.2.2	Develop and incorporate equity metrics in the evaluation of CAAP activities. This evaluation will be used as a criterion for the CAAP Action Group, Community Climate Commission, and budget team during review of program cost, viability, and success.
E-2.1.2	Ensure equitable implementation of grid resilience actions by partnering with vulnerable neighborhoods and non-governmental organizations to develop resilience hubs--community facilities that offer power and other community services during times of need. Establish criteria to screen and select locations for community microgrids to support grid and community resilience.
H-1.1.2	Increase energy efficiency funding options for income-qualified families (low-interest financing, on-bill financing, Pay as You Save, PACE, etc.).
H-1.6.2	Develop affordable and efficient (temporary/transitional) housing options.
T-1.5.4	Preserve and enhance affordable housing as well as infill development, especially near bus service.
HS-1.1.6	Conduct a needs assessment of accessible community centers for during extreme weather or other emergency situations. Create a development improvement plan, if needed.
HS-1.2.2	Increase availability to cooling mechanisms in low-income housing and rental units (e.g., air conditioning units, fans, window screens).

Climate Action Targets

City staff and Task Force members worked closely with the Columbia community to set overarching goals for the CAAP. These goals set the foundational framework for the strategies and actions of the CAAP and allow Columbia to track progress on achieving its vision for climate action. The goals below include greenhouse gas reduction targets in line with global scientific, peer-reviewed studies on necessary emissions reductions. To set reduction targets, the Task Force assessed Columbia's forecasted greenhouse gas emissions, listened to public input, reviewed peer cities' targets, and reflected on the community's climate ambitions.

Using the 2015 GHG inventory as a baseline year, the community and municipal reduction targets are:³

- **Community-wide** GHG emissions: 35% below baseline by 2035, 80% by 2050 and 100% by 2060.
- **Municipal operations** GHG emissions: 50% below baseline by 2035 and 100% by 2050.

This 80x50 community-wide target—an 80% reduction in greenhouse gas emissions by 2050—is broadly accepted by cities, states, and nations and prepares the city for carbon neutrality by 2060. The 80x50 target aligns with the Paris Agreement and scientific understanding of the reductions necessary to avoid catastrophic risks of climate change.⁴

To assess the feasibility of attaining these communitywide targets, the City commissioned the development of a “wedge analysis.” This forecasting analysis estimates potential GHG emission reductions associated with strategies and actions in the plan. Wedge analysis findings, presented at the beginning of the “Sector-Specific Strategies and Actions” section, suggest that full implementation of the CAAP will be sufficient to meet the community's near- and long-term GHG emission reduction targets.

To support achievement of the community's overarching GHG emission reduction goal—and to adapt to climate change—this plan includes sector-specific goals for climate action. For each emissions or adaptation sector, these overarching goals will guide the implementation of CAAP strategies in support of Columbia's climate vision.

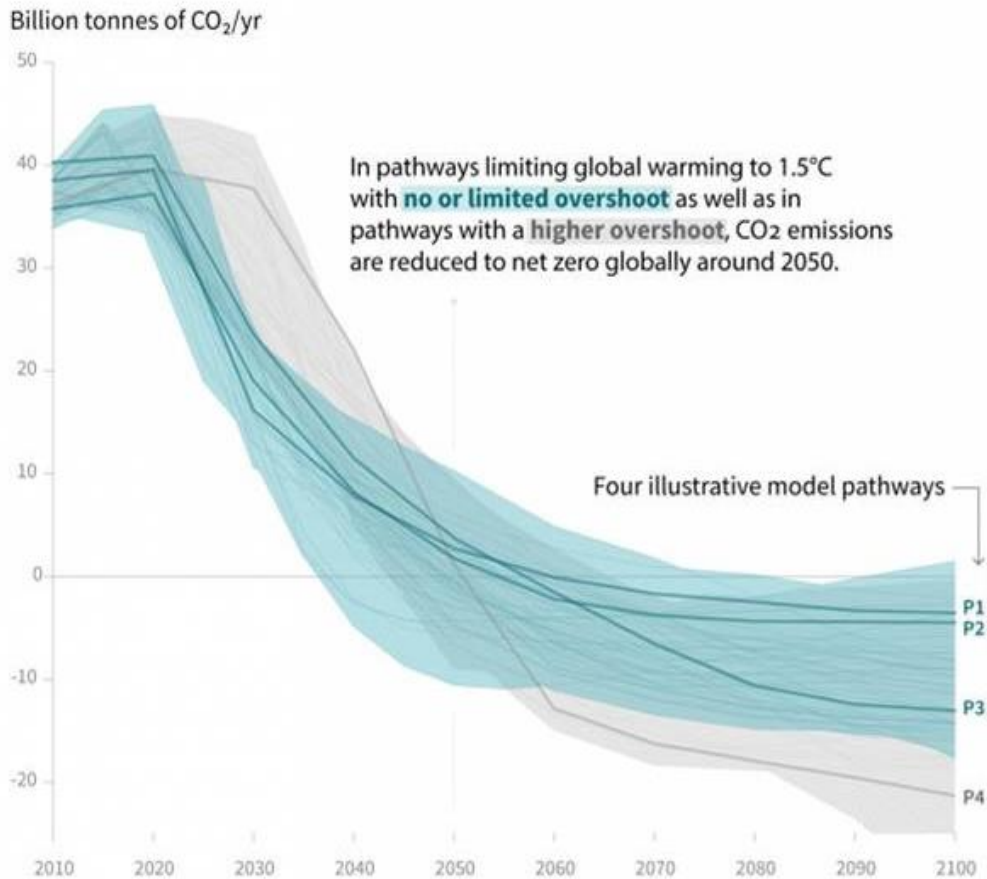
³ The City considered using 2010 as a baseline year for consistency with the Intergovernmental Panel on Climate Change Special Report findings but decided to use 2015 due to data inconsistencies in the 2010 GHG inventory.

⁴ “Framework for Long-Term Deep Carbon Reduction Planning.” *Carbon Neutral Cities Alliance*. 2018.

Columbia's Goals and the IPCC

This Plan is intended to allow for course corrections, giving us the ability to address the evolving science of climate change. In 2018—after Columbia had approved its 80x50 goal—the Intergovernmental Panel on Climate Change (IPCC) released a Special Report that describes the expected impacts of 1.5°C and 2.0°C warming and lays out pathways for limiting average global warming to those levels. As illustrated by the figure below, the report indicates that limiting warming to 1.5°C can only be achieved if action is taken to reduce global carbon dioxide emissions by about 45% from 2010 levels by 2030 and to 'net zero' by around 2050. Limiting warming to 2°C requires net global CO₂ emissions to decrease by about 25% from 2010 levels by 2030 and reach 'net zero' by around 2070. We will continue to work to meet the most rapidly attainable emissions reductions.




Global total net CO₂ emissions



Source: IPCC Special Report on 1.5°C

Sector-specific goals for climate action

The goals of the CAAP, listed below, address both climate mitigation (reducing greenhouse gas emissions) and climate adaptation (improving resilience to climate impacts), and are denoted as follows:

	Climate mitigation strategy (reduces greenhouse gas emissions)
	Climate adaptation strategy (increases resilience to climate impacts)
	Both (addresses both mitigation and adaptation goals)

Implementation



Increase City staffing and capacity to support community climate action.



Establish climate action as a priority for the City Council and the community.



Establish CAAP goals as priorities in the activities of the City of Columbia as an organization.

Energy



Increase local renewable energy generation and procure renewable energy.



Maintain reliability of local energy supply and local distribution.

Housing, Building & Development



Reduce housing-, building-, and development-related energy consumption and improve resiliency.

Transportation



Reduce travel by car.



Reduce greenhouse gas emissions from vehicles.

Waste



Reduce waste production.



Increase waste diversion.



Improve waste system management.

Health, Safety, and Well-being



Prepare the community and public safety and health services for anticipated climate change impacts.



Reduce emissions associated with the food system.

Natural Resources



Increase climate resilience and carbon sequestration potential of public and private lands.



Reduce per capita water usage.



Reduce negative impacts from stormwater runoff and flooding.





Why Act?

Climate Change and Columbia

Climate change, is caused by an increase in the abundance of heat-trapping gases in our atmosphere. Human activities worldwide—primarily the burning of fossil fuels and clearing of forests—have contributed to the increased concentration of these greenhouse gases in the Earth’s atmosphere. Increased concentrations of carbon dioxide and the resultant increase in global temperature both contribute to a multitude of cascading impacts from climate change. These impacts include changes in precipitation intensity and frequency, natural animal and plant systems, sea level, and disease risk.

Climate change is different from weather. Climate change is a shift in the long-term, average weather patterns. The current, rapid pace of climate change is unprecedented and may exceed many plants and animals ability to adapt. Furthermore, each year human activities continue to release greenhouse gases into the atmosphere makes it more difficult to reverse this trend. The rapid rate at which our actions contribute to climate change must be met with an equally urgent and intense effort to reduce emissions and remove greenhouse gases from our atmosphere.

Columbia has already begun experiencing the impacts of climate change, and these observed changes are anticipated to worsen over time. Observed and projected future changes in the local climate are summarized below:⁵

	Observed Changes	Projected Future Changes
 Temperature	+1.3°F increase in average annual temperature	+50 days per year above 95°F
 Precipitation	+10% increase in precipitation	+7% increase in average annual rainfall Summer droughts more common
 Air Quality	13 days of unhealthy levels between 2012 and 2014	Poor air quality days more common and severe
 Severe Storms and Tornadoes	High tornado activity has occurred earlier in the year	More favorable conditions for storms

⁵ Much of the information included in this summary was based on the Climate in the Heartland report analysis, which used historical climate data from the Columbia Regional Airport weather station, 28 National Weather Service cooperative stations across Missouri, and climate change projections completed by Iowa State University scientists based on downscaled data from the international Coupled Model Intercomparison Project 3 (CMIP3) and nine different global climate models

Risk and vulnerability

To better understand the extent to which these climate changes will affect Columbia, this plan includes a climate vulnerability assessment. The vulnerability assessment was conducted with support from the Climate Action and Adaptation Task Force and City staff and identifies key climate-related risks to Columbia's resources.















The vulnerability assessment assigns vulnerability rankings to key systems within the Columbia community (see figure), taking into account three key factors in relation to anticipated climate change impacts:

- **Exposure:** the number of people and value of assets in harm's way or at risk due to their physical location.
- **Sensitivity:** the severity of consequences of being exposed to these risks and the degree to which climate change exacerbates existing stressors.
- **Adaptive capacity:** steps the City and community are already taking to prepare for climate change impacts and whether they have existing capacity to accelerate and/or expand those efforts, if needed.

The pages below summarize the impacts of climate change to populations, regions, or infrastructure that are especially vulnerable within the following focus areas:

- Health, safety, and wellbeing
- Open space and agriculture
- Water supply and quality

Relative Vulnerability

Relative Vulnerability			
HIGH			
	Heat stress	Air quality	Vector-borne diseases
MEDIUM-HIGH			
	Housing	Mental health	
MEDIUM			
	Agriculture	Stormwater management	
LOW-MEDIUM			
	Transportation	Surface water quality	Drinking water supply
			
	Trees and open space		
LOW			
	Solid waste	Energy	Drinking water quality

A full set of vulnerability assessment findings will be provided as an appendix in the final plan.

Health, Safety and Well-being



As the climate continues to change over the next 30 years...

HIGH VULNERABILITY



More days of **poor air quality** and greater **exposure to allergens** could exacerbate respiratory illnesses in our community.

HIGH VULNERABILITY



Warmer temperatures and more extreme heat may increase the risk of **heat-related illness** in Columbia.

HIGH VULNERABILITY



Warmer temperatures may increase **vector-borne diseases** like West Nile Virus and Lyme disease.

MEDIUM VULNERABILITY



Exposure to more climate-related disasters may lead to more anxiety and other **mental health consequences**.

Other potential risks

RISK TO LIFE: Flash flooding is a risk in Missouri, which poses danger to people in cars on flooded roadways. Climate change is expected to bring more heavy rainfall events, which increases the risk by reducing drivers' visibility.

FOOD SECURITY: Drought years may hamper food production in Missouri and elsewhere.

Who is most at risk?

"Every American is vulnerable to the health impacts associated with climate change" (U.S. Global Research Program, 2016).

In general, children, older adults, women who are pregnant, outdoor workers, those with pre-existing illnesses, and those with weak social ties are more vulnerable to climate change-related health impacts.

What are we already doing?

- Health promotion and education
- 9 public warming/cooling centers
- The Voluntary Action Center's Air Conditioner Exchange and Summer Fan programs
- Vision Zero to make Columbia's roads safer



Natural Systems: Open Space, Street Trees, and Agriculture



As the climate continues to change over the next 30 years...

MEDIUM VULNERABILITY



Increasing drought, warmer temperatures, and changes in precipitation will threaten the quality and quantity of crop yields and make crops more prone to pests and disease, potentially affecting **urban gardens as well as other farms** in the county.

Climate change also brings a longer planting window and longer growing season, but more extreme conditions may outweigh those benefits.

LOW-MEDIUM VULNERABILITY



A warming climate and drought will **stress street trees**, and provide more favorable conditions for disease, pests, and invasive vegetation.

Existing habitats including those in our parks, will be increasingly threatened under a rapidly changing climate.

Street trees and parks also play an important role in mitigating the urban heat island effect and capturing carbon.



What are we already doing?

- Habitat restoration projects
- Monarch/pollinator gardens
- Converting vegetation in roundabouts, medians, and along roads to native plants
- Emerald Ash Borer Management Plan ready in case of infestation
- Collaborations to create an Agriculture Park

Water Supply and Quality



As the climate continues to change over the next 30 years...

LOW-MEDIUM VULNERABILITY



More heavy rain events may decrease **surface water quality** in Columbia's streams and lakes, which could harm habitats and limit recreational opportunities.

LOW VULNERABILITY



The **quality of Columbia's drinking water supply** is largely protected from stormwater pollution due to the local groundwater hydrology.

LOW-MEDIUM VULNERABILITY



Warming temperatures, increasing drought, and changes in precipitation may limit water resources and increase demand. Columbia's **drinking water supply** is still likely to remain sufficient. Investments may be needed to expand water infrastructure.

Those with the greatest water needs may be most sensitive to future water supply constraints:

1. Industrial Customers
2. Healthcare Facilities
3. Educational Facilities



What are we already doing?

- Rain barrel sales
- Backup storage of water for emergencies
- Stormwater management program and plan
- Proposed water treatment plant upgrades

The Social Cost of Carbon Pollution

Social, environmental, and economic costs of climate change largely due to burning fossil fuels are not included in the price we pay for the fuels themselves. Burning fossil fuels results in economic consequences, such as infrastructure damage from flooding, fires, or extreme storms. Despite the very real nature of these costs, the market price of fossil fuels does not include these societal cost “externalities.”

Identifying the true social costs of burning fossil fuels can help policymakers decide if investments in climate action are cost effective. Researchers, including those at the U.S. Environmental Protection Agency (EPA), have worked to quantify the economic losses associated with each metric ton of carbon dioxide burned. This is called the “social cost of carbon.”

The U.S. Environmental Protection Agency estimates a range of possible social costs of carbon depending on the year and discount rate applied to the future. These estimates range from \$36 per metric ton of carbon dioxide equivalent (MTCO_{2e}) in 2015 to \$69 per MTCO_{2e} in 2050.⁶ However, the EPA acknowledges that current modeling does not include all important damages—estimates by other agencies and researchers are far higher. Some recent estimates have determined the social cost of carbon could be as high as \$100-\$200 per MTCO_{2e}.⁷

To reach Columbia’s 2050 goal, the community will need to reduce emissions by 2.3 million MTCO_{2e} compared to the business-as-usual scenario. Using the 2050 estimated social cost of carbon of \$69 per MTCO_{2e}, achieving this reduction would equate to \$158 million in avoided societal costs.

⁶ “The Social Cost of Carbon.” 2017.

⁷ Nuccitelli, Dana. “Republican hearing calls for a lower carbon pollution price. It should be much higher.” *The Guardian*. 1 March 2017. www.theguardian.com/environment/climate-consensus-97-per-cent/2017/mar/01/republican-hearing-calls-for-a-lower-carbon-pollution-price-it-should-be-much-higher. Accessed 3 July 2017.

Columbia's contributions to climate change

Columbia has been reporting its community greenhouse gas emissions every five years since 2000 and recently completed its first greenhouse gas inventory of municipal operations. Activities that result in the release of greenhouse gas emissions include burning fossil fuels for transportation and energy, disposing of waste in landfills, and treating wastewater. From 2000 to 2015, community greenhouse gas emissions increased by 12% to 2.8 million MTCO₂e in 2015. However, per-capita emissions decreased over that time period by 20% to 20.5 MTCO₂e/person. The first municipal greenhouse gas inventory found that municipal operations resulted in the release of 68,252 MTCO₂e in 2015.

Community Emissions Profile

The community emissions inventory accounts for the emissions associated with activity within Columbia. When residents burn fossil fuels within the city, by driving cars and burning natural gas to heat homes, those emissions count towards the inventory. Sources of GHG emissions from the Columbia community include from the commercial, residential, and industrial transportation, building, and waste sectors.

When residents and businesses consume electricity, the inventory counts emissions associated with the production of electricity, even if those emissions occur outside city boundaries. In 2015, Columbia's total greenhouse gas emissions were 2,429,305 MTCO₂e in 2015. It would take over 3 million acres of new forest to sequester this much carbon in one year.⁸

Over time, total community emissions have increased by 12%, but per-capita emissions have decreased. In 2015, per-capita emissions were 20.5 MTCO₂e/person, down from 25.7 MTCO₂e/person in 2000.

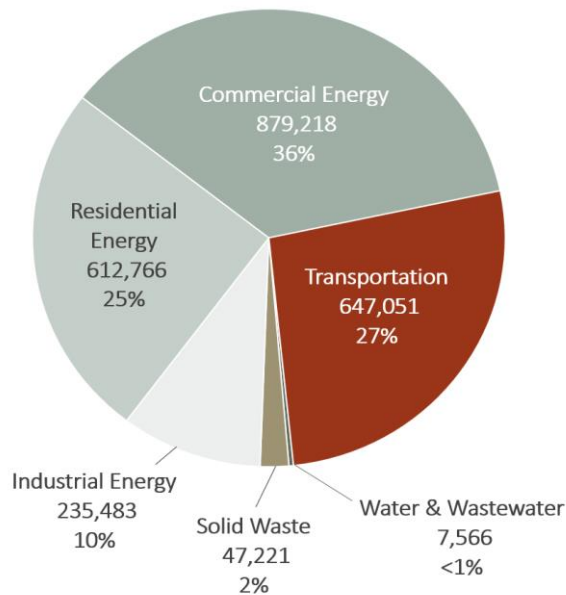
The **residential** sector includes single and multi-family homes.

The **commercial** sector includes most businesses and institutions, including retailers, office space, government operations and universities.

The **industrial** sectors includes facilities that host industrial processes, including energy generation facilities.

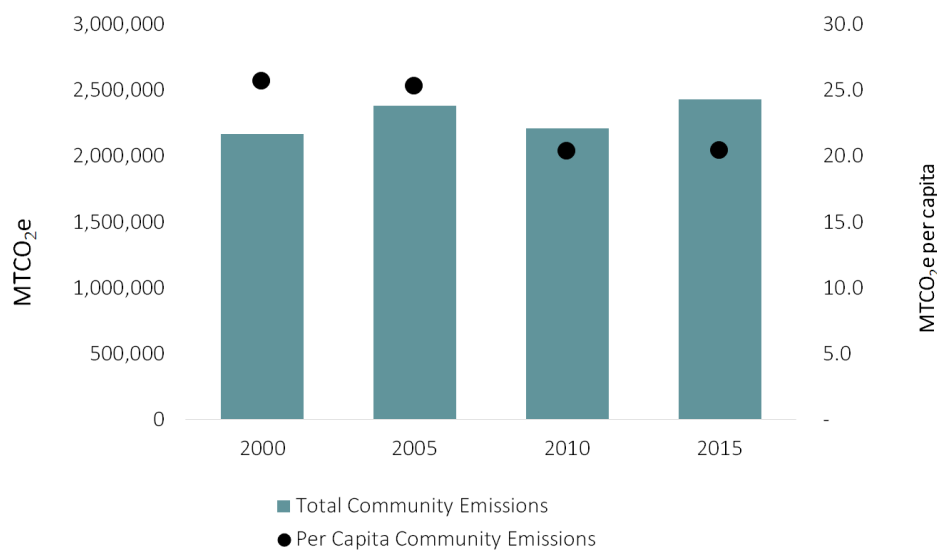
⁸ "Greenhouse Gas Equivalencies Calculator." United States Environmental Protection Agency. December 2018. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

Caption: Sources of communitywide greenhouse gas emissions in Columbia include transportation, residential, commercial, and industrial energy, and waste (in MTCO₂e, for 2015).



Electricity emissions are the single largest source of emissions for Columbia. Three utilities provide electric power to the community: Columbia Water and Light, University of Missouri Columbia Power Plant, and Boone Electric Cooperative. In order to serve their customers' needs, each has both local generation facilities and purchases power from remote production facilities.

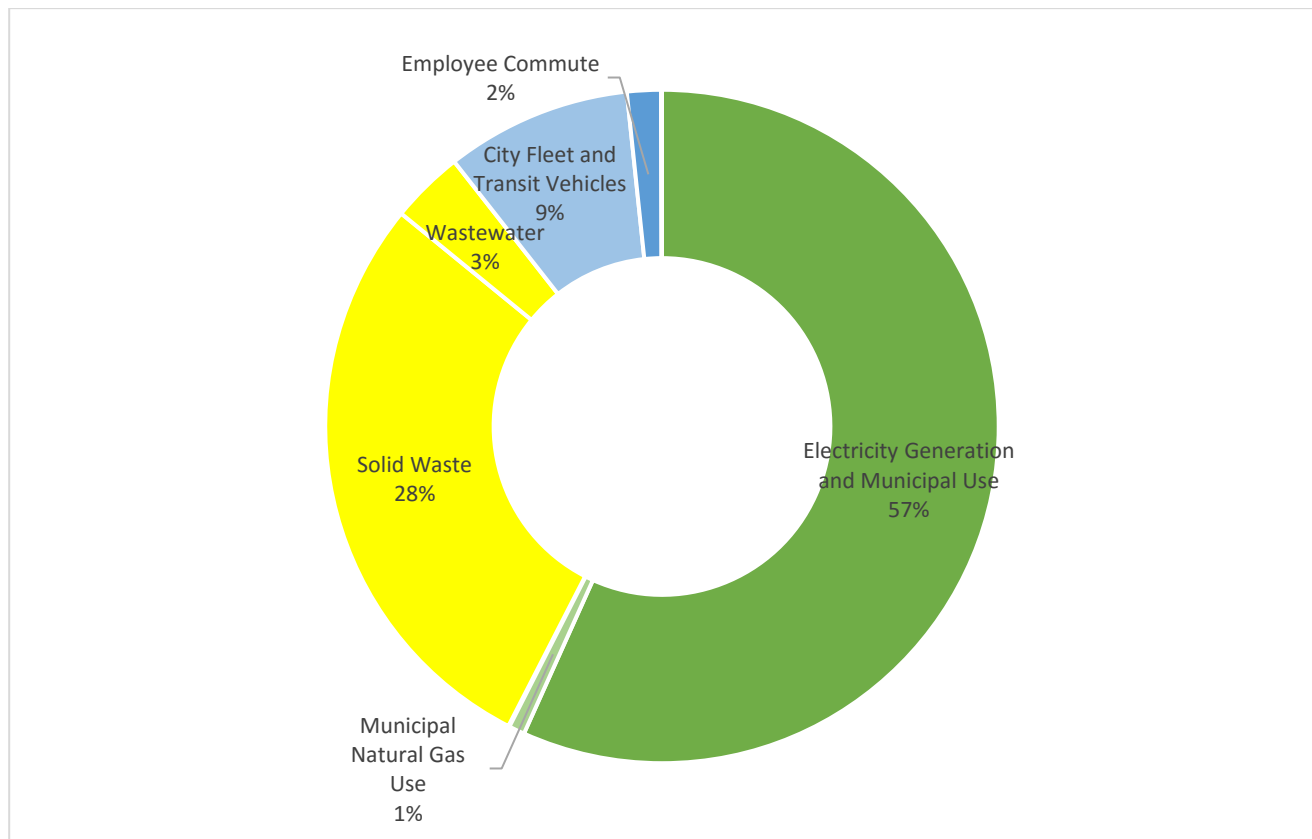
Caption: Total communitywide greenhouse gas emissions in Columbia have fluctuated over time, while per-capita emissions have largely decreased.



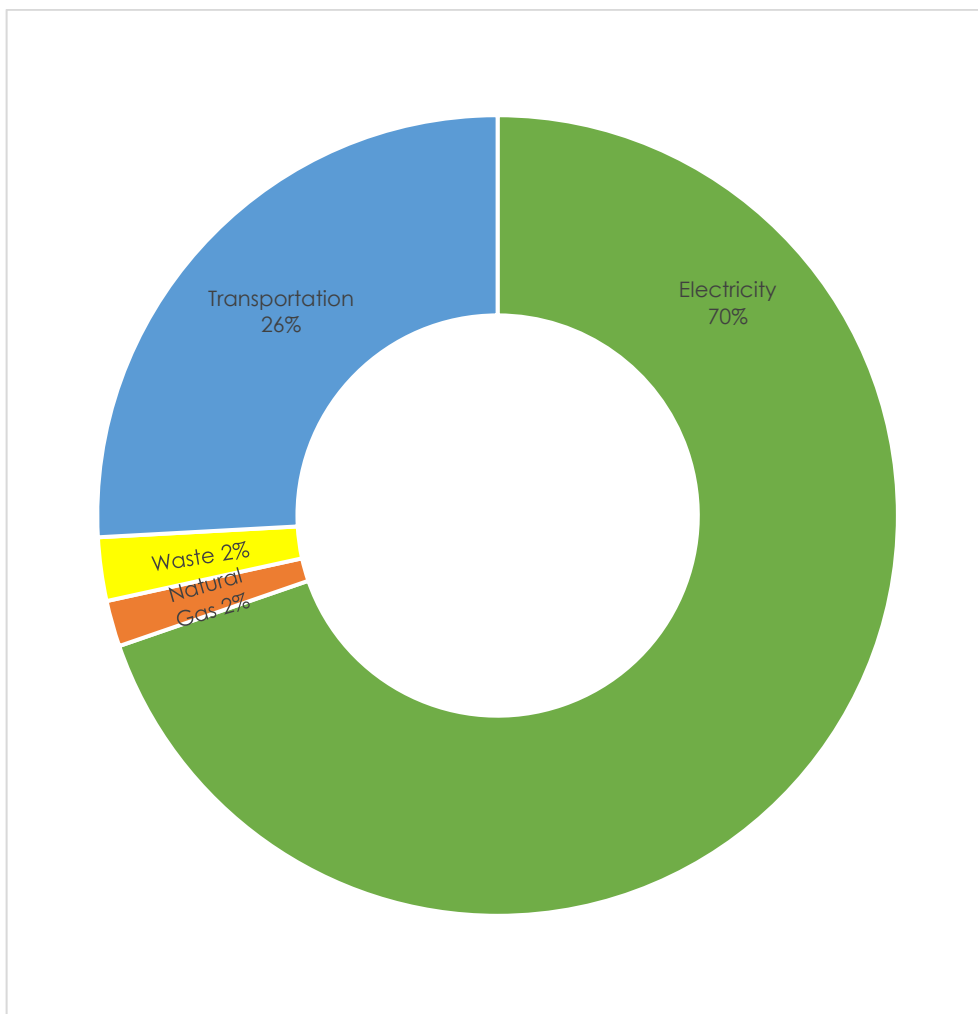
Municipal Emissions Profile

As a part of the development of this plan, a municipal emissions inventory was completed to account for the impact of the full range of utilities and other services provided to the community by the City (e.g., solid waste, water and wastewater treatment, public transportation and electricity), as well as the impact of day-to-day operations as an organization. Energy emissions include those from 1) electricity generated locally by the City of Columbia as well as the electricity used for City operations and generated elsewhere, 2) natural gas used at city facilities, and 3) fuel oil used for heating at the airport. Energy emissions total 92,821 MTCO₂e or 58% of the 2015 municipal inventory. Emissions associated with landfill operations and wastewater treatment total to 53,072 MTCO₂e (31%). Greenhouse gases associated with operation of City fleet and transit vehicles, City employee commuting, and ground equipment at the airport total 17,630 MTCO₂e or 11% of the total emissions. Reporting total emissions from these sources is important and will continue to inform broader process changes and our progress toward meeting reduction goals.

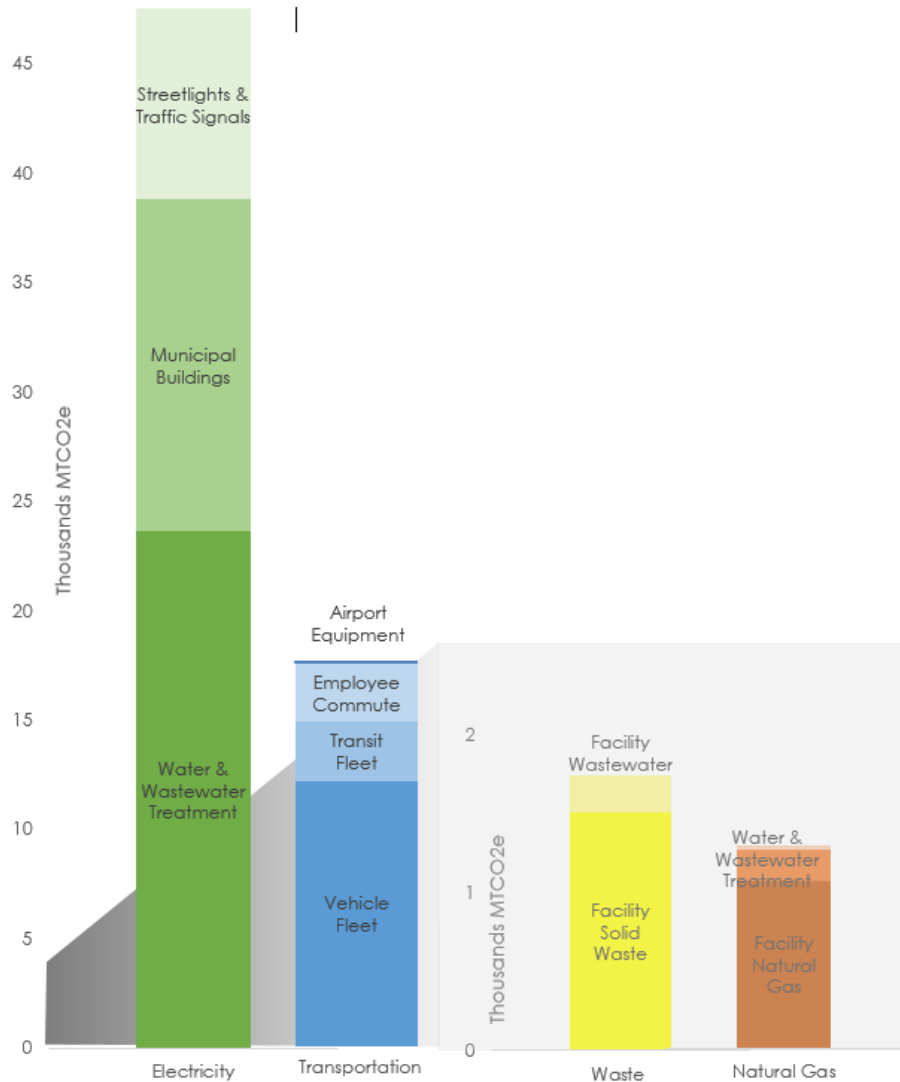
Caption: Sources of greenhouse gas emissions from City of Columbia operations including community utility use (2015, total = 163,523 MTCO₂e). Emissions from airport ground equipment and fuel oil use (0.05% and 0.06% respectively are not labeled here for clarity).



The chart below provides a breakdown of the impact of the operations of the City of Columbia as an organization. This view removes the impact of providing solid waste and wastewater treatment, as well as local electricity generation to the community at large. The chart does include emissions resulting from day-to-day City operations.



Caption: Sources of greenhouse gas emissions from City of Columbia operations excluding community Utility use (2015, total = 68,252 MTCO₂e).



Caption: Detailed contribution of business activities to municipal emissions (2015, total = 68,252 MtCO₂e.) Emissions from fuel oil use at the airport (96 MtCO₂e) are not included here for clarity.

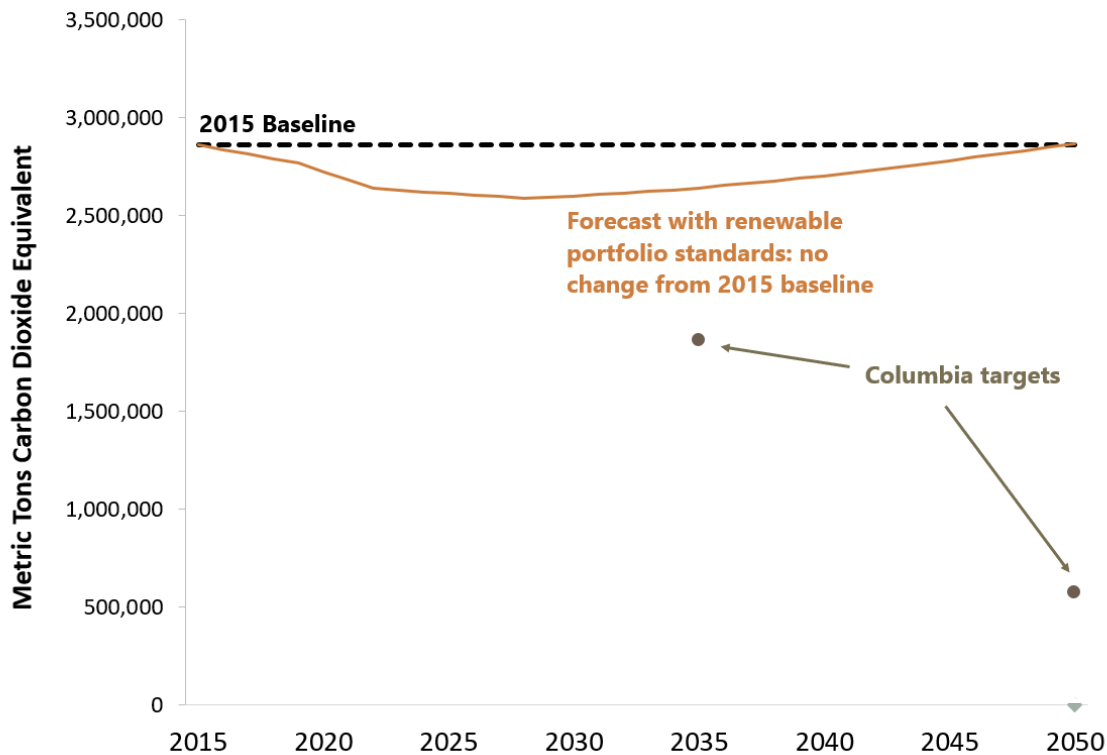
How will emissions change in the future?

A business-as-usual forecast provides an estimate of potential future emissions, assuming that the city takes no further action. It considers the influence of external factors on Columbia's emissions, such as population growth, changes in the regional electricity fuel mix, and energy demand.

The business-as-usual forecast for Columbia is presented below. The following key assumptions for Columbia's business-as-usual forecast were refined in consultation with the Task Force and City staff:

- 1.3% annual employment growth rate from the CATSO-County-City Employment Projections 2050.
- 1.5% annual population growth rate from the CATSO-County-City Employment Projections 2050.
- Reductions in personal vehicle carbon intensity factors based on CAFE standards.
- Energy demand projected linearly based on 2012-2017 electricity demand.⁹
- The City meets its renewable portfolio standards (RPS): 15% renewable energy by 2017, 25% by 2022, and 30% by 2028.

The forecast estimates that Columbia's overall emissions will be roughly the same in 2050 as they are in the baseline year, 2015. This scenario conveys the need for ambitious climate action to meet the City's short- and long-term emission reduction goals. The goals needed to curb the increase in average global temperature to 1.5°C is also provided for context.¹⁰



⁹ This energy demand forecast does not take into account anticipated future demand from electric vehicles.

¹⁰ Source: IPCC Special Report on 1.5°C (2018)

Progress to Date and Concurrent Efforts

Existing Climate Efforts

Columbia is already taking initiative to mitigate its climate impact and promote community wellbeing. Columbia's City Council and staff worked to create sustainability programs for the community, adopted building codes and policies to support climate change action, and improved municipal operations. To date, the City has taken the following steps, organized by sector.

Climate

- Endorsed the US Mayors Climate Protection Agreement.
- Established the Mayor's Climate Protection Awards to recognize local businesses and organizations that promote sustainability.
- Formed a Mayor's Task Force to guide development of the Climate Action and Adaptation Plan.

Health, Safety, and Well-being

- Advocates for local, healthy food production.
- Partners with regional emergency responders on preparedness planning.
- Created nine public warming/cooling centers.
- Participates in the Voluntary Action Center's Air Conditioner Exchange and Summer Fan programs.
- Collaborated to create an Agriculture Park.

Energy

- Adopted Renewable Energy Standard ordinance that require an increasing percentage of electricity to be generated with renewable sources.
- Provides solar PV rebates and loans for customers.
- Has entered into 10MW solar PPA.
- Operates Landfill gas to energy plant at the municipal landfill.

Transportation

- Provides Go COMO bus services.
- Uses CNG and electric vehicles.
- Updated building and zoning codes.
- Adopted Vision Zero to make Columbia's roads safer.
- GetAbout Columbia's efforts to improve walking and biking opportunities.
- Implements Columbia Imagined.
- Maintains and builds trails systems connecting residents, including the development of a 30-mile loop.

Waste

- Provides waste audits and consulting.
- Maintains a bioreactor landfill/bioenergy plant.
- Provides yard waste and recycling drop-off centers.
- Manages household hazardous waste and paint for re-use.

- Provides waste education through: public events, the recycling ambassadors program, compost workshops, the CoMo Recycle and Trash App, and Waste Wizard.
- Runs programs to properly dispose of waste through: drug takeback, e-waste, tire collection, fix-it fairs, and commercial food waste recycling.

Housing and Buildings

- Provides energy efficiency incentives, energy loans, and rebates to residential and commercial customers.
- Created the Community Land Trust Lynn Street Cottages.
- Runs buyout programs for homes in floodplains.
- Provides home repair and rehabilitation funds to low- and moderate-income families.

Natural Resources

- Conducts habitat restoration projects.
- Manages native pollinator gardens.
- Uses native plants to landscape roundabouts, medians, and along roads .
- Adopted the Emerald Ash Borer Management Plan to prepare for infestation.
- Purchasing land and creating parks so that no one is more than two miles from recreational green space.

Water Supply and Quality

- Proposed water treatment plant upgrades.
- Inspects and maintains hundreds of stormwater treatment and control structures.
- Sells rain barrels and provides homeowners with native, low-input landscaping assistance.
- Created backup storage of water for emergencies.
- Adopted stormwater management program and plan.

Education and Outreach

Activities and programs include:

- Recycling Ambassadors
- Tree Keepers
- Stream team
- Composting workshops and community gardens
- Energy and water conservation education
- Classroom and school waste audits
- Native plant education
- “Fix it” fairs
- Bicycle safety classes and repair co-op

Moving This Plan Forward – Implementation Strategy

Implementing the CAAP requires motivating staff, finding funding for strategies, involving community members to make key changes, and sustaining momentum. Columbia has already taken steps to improve community sustainability. The following implementation strategies build on those efforts to ensure the climate action and adaptation strategies are completed. This section of the plan includes:

- A **timeline** for taking action, including projects that could be started tomorrow as well as transformations that will happen over the long term.
- A plan for **sustaining community, government, and stakeholder buy-in**. Making progress on climate action requires leadership and commitment from the city government and from the community. Community engagement has been a vital part of the CAAP development process and sustained community support is going to be equally important moving forward.
- A **structure for ongoing monitoring, evaluation, and reporting** on CAAP progress. Investing in data collection and consistent reporting is a key aspect of implementation. City staff will track and regularly report on CAAP indicators, greenhouse gas emissions, and notable progress on implementing strategies. Evaluation of progress will include revisiting project priorities based on new information regarding action need, effectiveness, feasibility, and cost.

Timeline for Implementation

Climate actions build on each other and all require community, staff, and elected officials' support. A specific overview of Year 1 implementation is outlined below, followed by a broader priority action list for initial implementation. Implementation details for all priority strategies and actions in the plan are provided in Appendix A (to be released with the final plan).

Year 1 Implementation Overview

The initial focus will be on forming the foundation for ongoing action by creating institutional accountability and maintaining public support. Year 1 actions include:

- Create **Citizen Climate Commission** to advise staff on the implementation of the CAAP.
- Ensure the critical functions of the plan are adequately staffed and supported.
- Identify opportunities for and barriers to the **equitable implementation** of CAAP strategies.
- Form an internal **CAAP Action Group** with representatives from across City departments tasked with short and medium range planning of CAAP implementation activities.
- Create a **data management and reporting system** for key performance indicators of activities related to CAAP goals.
- Include a report in the **City Manager's proposed budget** on the existing and proposed projects that improve mitigation and adaptation efforts.
- Develop specific **funding options** for CAAP priorities.

Priority Early Actions

The following actions would be prioritized early in CAAP implementation to set the city up for success in achieving long-term goals:

- **Set a “clean fuel” foundation for realizing early wins.** Behavior change is hard and takes time to achieve. Efforts to change our community driving habits, car purchasing decisions, and home and business energy consumption requires careful planning, time-intensive policy development, and resource-intensive programming—often with unknown outcomes. Given this uncertainty and sometimes slow-developing results, focusing on establishing a clean, affordable and renewable electricity source as a first phase of CAAP implementation directly addresses over 60% of our total community emissions. Achieving 100% renewable electricity will leverage the impact of actions requiring a shift from fossil fuels to electricity (e.g., gasoline to electric vehicles), making them more impactful and attractive. This approach also builds on the existing renewable energy goals of our municipal electricity utility, Water & Light. Furthermore, pathways toward achieving 100% renewable electricity such as community solar and renewable energy credits (RECs) are well-established approaches and could be emulated from other utilities across the country. Prioritizing these clean fuel actions will provide an important and viable early success for the CAAP that can help energize the community and facilitate achievement of the City’s near-term emission reduction goals. However, this initial focus does not mean that the City should not start on other infrastructure or behavior change actions in the plan as well—a balanced, mixed portfolio of actions will be important for successful, comprehensive plan implementation.
- **Focus early policy and programming on fuel switching.** With a 100% renewable electricity pathway identified and underway, we can begin shifting focus to fuel switching. Specifically prioritizing a transition of our residential and business energy use in transportation and buildings from fossil fuels to renewably generated electricity. This includes actions to transition fuels used for space and water heating in buildings to renewable electricity as well as requiring or encouraging electric passenger vehicle adoption. We see this path as a viable option for Columbia, as the current high dependency on single-occupancy vehicles is unlikely to change dramatically in the near-term—and purchasing decisions made now will have lasting impacts. For example, the average U.S. household replaces vehicles only every 10 years, so actions taken now may not realize their full potential until 2030 at the earliest. Continued improvements to our existing transit, biking and walking infrastructure will also be a key element in reducing our transportation emissions. Reducing reliance on fossil fuels also brings economic, public health, and resilience benefits, as consumers are no longer subject to price fluctuations in natural gas and petroleum markets, and local air pollution from internal combustion engines is eliminated.
- **Affordable density.** Actions to prepare for and increase density bring a host of benefits to a community. When people live closer together, the average size of living and work space declines, heating and cooling costs go down, the need for individual vehicles is reduced, and travel distances decline. Increasing density would also require new construction in Columbia—presenting an opportunity to incorporate energy efficient technologies from the start. Dense communities can create other opportunities for climate mitigation and adaptation, such as eco-districts, avoided development of important natural areas and habitats, and increased social cohesion and resilience. It will be important to create density in a manner that does not conflict with other adaptation and equity goals, however; for example, optimizing green space and tree canopy cover to provide carbon sequestration, shade, and habitat.

Sustaining Community Support

Throughout the CAAP development process, **public input** has been essential to informing CAAP priorities. Moving forward, individual actions will be necessary to meet City emission reduction targets. The City will continue to foster conversations on climate change and climate leadership through public engagement by partnering with existing community groups, neighborhoods, and business groups in climate action. In addition to informing CAAP priorities, public input throughout the CAAP development has also fostered numerous education programs and outreach ideas that will be developed and promoted as the plan is implemented. These ideas range from public service campaigns around the importance of properly inflated tires for vehicle efficiency to including greenhouse gas emissions information on utility bills.

To formally maintain public participation in CAAP implementation, CAAP strategies include creating a **citizen climate commission**. This commission will advise staff, maintain community engagement, and provide accountability.

Additionally, strengthening **City staff capacity** and knowledge will help maximize the speed and impact of CAAP implementation. Internal staff development can include workshops on climate change, support for strategy implementation, and development of CAAP planning metrics.

Monitoring and Evaluation

City staff will conduct ongoing monitoring, evaluation, and reporting on CAAP progress. This section outlines a high-level plan for these activities. Key aspects of monitoring and evaluation include:

- **Conducting annual greenhouse gas inventories** and report results to City Council. Greenhouse gas inventories inform progress towards meeting reduction targets and highlight areas that need additional action.
- **Establishing performance metrics and a tracking structure** for monitoring progress within City departments. Monitoring key performance indicators (KPIs) will help track progress on individual CAAP actions. A list of all KPIs will be provided in an appendix of the final plan.
- **Evaluating and reporting progress.** Reporting the status of CAAP implementation to City Council annually will ensure there is consistent progress. It is important to spread out actions over many years so that CAAP strategies can build on each other.
- **Adapting strategies and actions.** The results of the greenhouse gas monitoring and evaluation of actions using key performance indicators will be used to update the CAAP as necessary to meet CAAP goals.

What will be tracked?

Two primary elements of the CAAP will be monitored:

- **Action progress:** more qualitative descriptions of progress City is making toward implementation of actions in the plan.
- **Key performance indicators:** quantitative metrics that indicate progress towards higher-level goals and target outcomes of the plan.

Where will indicators be tracked and reported?

City staff will calculate and track all indicators. Key indicators will be publicly viewable on the online CAAP dashboard.

City staff will develop annual progress reports for City Council and the public. Progress reports will include a detailed appendix with all indicators and action-by-action progress.

Who will track indicators?

City staff will be responsible for calculating and reporting on indicators.

How often will CAAP indicators be updated?

The majority of indicators will be updated annually. Some indicators may be updated less frequently depending on how frequently new data are available.

What is the process for reviewing indicator progress?

The City will hold division-level meetings annually to identify goals, review progress, and identify course corrections and next steps. A dedicated group within the City—including Sustainability staff—will develop work plans from division-level outcomes.

How often will the CAAP be updated?

The CAAP, including targets and goals, will be updated every five years.

Cross-Cutting Strategies and Actions

Goal I-1. Establish climate action as a priority for the City Council and the community.

Strategy I-1.1: Include CAAP objectives in Council priorities.

I-1.1.1	Use recommendations in annual report to identify budgetary priorities that support implementation of the CAAP.
I-1.1.2	Identify State and Federal legislative issues that support the goals of the CAAP and enable its implementation.

Strategy 1.2: Utilize Citizen Climate Commission to support accountability, implementation, and awareness of the CAAP in the community.

I-1.2.1	Create Citizen Climate Commission to advise staff on the implementation of the CAAP. The Commission will represent the diversity of the community with relevant expertise, in the social, scientific, economic, and environmental components to CAAP strategies.
I-1.2.2	Advise staff in the preparation of annual CAAP progress report and recommendations for City Council.
I-1.2.3	Present annual CAAP progress report policy and budget priorities to City Council for acceptance.
I-1.2.4	Identify opportunities and barriers to equitable implementation of CAAP strategies.

Goal I-2. Establish CAAP goals as priorities in the activities of the City of Columbia as an organization.

Strategy I-2.1: Support integration of climate goals in all Divisions.

I-2.1.1	Hold biannual meetings with all Division Heads to highlight progress, plans and challenges related to projects with climate impacts.
I-2.1.2	Form a CAAP Action Group with representatives from across Departments tasked with short and medium range planning of CAAP implementation activities.
I-2.1.3	Develop a decision matrix to be used to integrate mitigation and adaptation priorities into City planning and standards (zoning, construction standards, CIP review). City departments will utilize forecasted model data (climate, health, population, economic, etc.) during these processes, where available.
I-2.1.4	Develop a process for requiring mitigation, adaptation and climate-equity impact assessments for all new policies and projects that meet threshold criteria, such as cost burden, vulnerability, or increase to net emissions.

Strategy I-2.2: Incorporate CAAP goals into the budget process.

I-2.2.1	Integrate annual CAAP report goals during the budget review process at the direction of the City Manager.
I-2.2.2	Include a report in the City Manager's proposed budget on the existing and proposed projects that improve mitigation and adaptation efforts.
I-2.2.3	Assessment of progress toward CAAP goals shall be included in the City Manager's annual performance review by the City Council.

Goal I-3. Strengthen City capacity to support community climate action.

Strategy I-3.1: Improve City staff capacity and knowledge of their role in meeting climate goals.	
I-3.1.1	Create a data management and reporting system for key performance indicators of activities related to CAAP goals.
I-3.1.2	Create and distribute an annual municipal adaptation and greenhouse gas emissions report to staff to be used in assessment of current and proposed activities.
I-3.1.3	Conduct annual GHG emissions inventories, including identification of improved processes for quantifying net carbon sequestration and solid waste emissions.
I-3.1.4	Continue to align performance measurements of CAAP actions with existing planning metrics.
I-3.1.5	Provide training and other capacity building opportunities to staff to facilitate creative, climate positive innovations in operations, project design, and implementation.
Strategy I-3.2: Support equitable climate action.	
I-3.2.1	Create a report that identifies the differential impact of climate change on neighborhoods and communities.
I-3.2.2	Develop and incorporate equity metrics in the evaluation of CAAP activities. This evaluation will be used as a criterion for the CAAP Action Group, Community Climate Commission, and budget team during review of program cost, viability, and success.
Strategy I-3.3: Develop community leadership capacity for and involvement in climate action.	
I-3.3.1	Align existing City educational and engagement programs with CAAP goals and programs. Provide additional support to education and outreach for the CAAP and its individual actions.
I-3.3.2	Engaging with community partners, identify unmet community needs, barriers, and opportunities to improve access to the green job economy for all community members.
I-3.3.3	Design and promote CAAP educational materials to ensure full engagement of community members by using methods that are accessible and relevant to all.
I-3.3.4	Develop CAAPtains to serve as ambassadors for the CAAP activities, especially youth.
Strategy I-3.4: Secure organizational and staff implementation capacity.	
I-3.4.1	Develop specific funding options for CAAP priorities.
I-3.4.2	Track cost savings associated with CAAP action across the City organization and allocate for use in supporting further mitigation and adaptation actions.
I-3.4.3	Evaluate staffing requirements to ensure successful CAAP implementation and allocate required resources.
Strategy I-3.5: Support CAAP progress through regular, transparent community reporting and education.	
I-3.5.1	Use online dashboard to report on the status of CAAP priority actions/KPIs (e.g., progress of actions that have been initiated, implementation schedule of other actions not yet started, community and municipal greenhouse gas emissions, equity impacts of actions implemented).
I-3.5.2	Host a community event every two years to celebrate annual progress report on the implementation of the CAAP.

Sector-Specific Strategies and Actions

The following sections detail the strategies and actions the City and community will need to take to help reach our carbon pollution reduction and climate resiliency goals. To reduce community and municipal greenhouse gas emissions, Columbia will have to accelerate the adoption of clean energy, reduce miles traveled in fossil fuel vehicles, phase in electric appliances, and reduce waste. Maximizing climate resilience will require ensuring the built environment can sustain people in extreme heat, through flooding, and changing ecological conditions. The City will achieve this by developing building resilience, creating climate-resilient green space, and providing community centers. This plan's actions focus on policies, programs, and infrastructure. It is expected that education and outreach actions will be developed as we implement. Some of the potential actions discussed during the plan's development are included in the introduction for each sector.

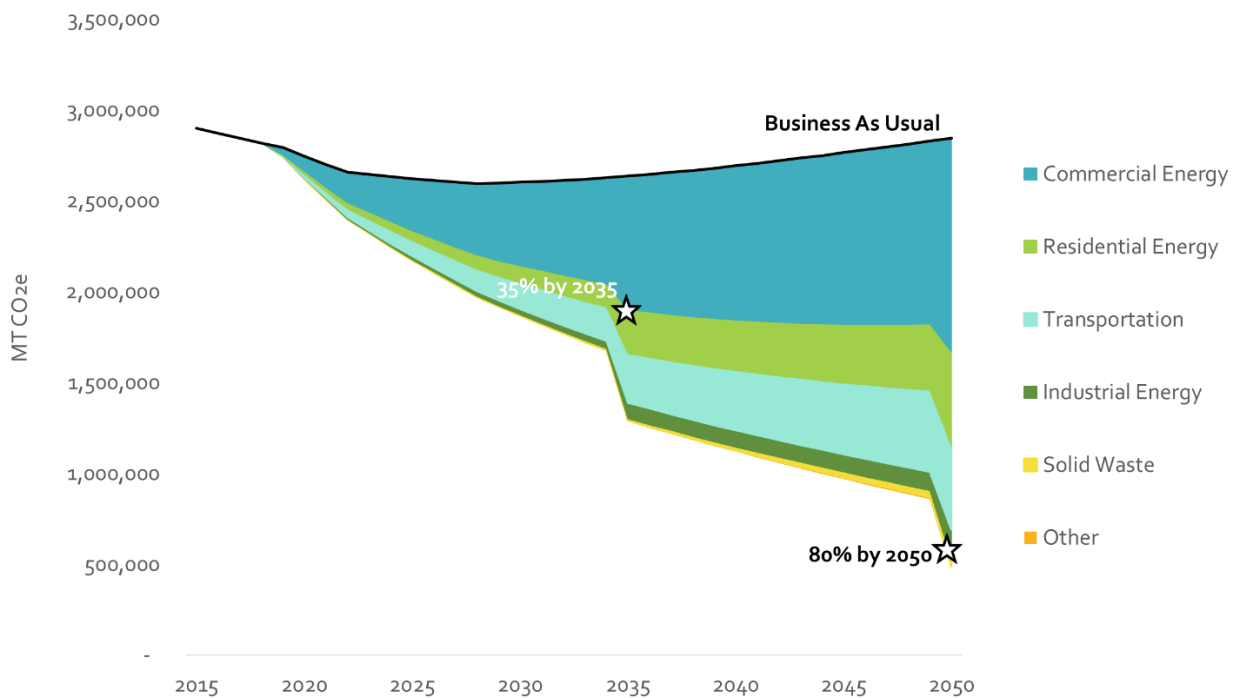
Modeling Impact: The Wedge Analysis

The wedge analysis models the potential impact of fully implementing CAAP strategies. The wedge analysis builds on Columbia's forecast and incorporates emissions savings associated with cleaner electricity, reductions in energy demand, efficient vehicles, solid waste management, and tree carbon sequestration. The wedge analysis suggests that if Columbia fully implements the strategies and actions of the CAAP, the community can meet its GHG reduction targets. **Specifically, the wedge analysis shows Columbia can achieve a 56% reduction in community-wide emissions from 2015 levels by 2035, and an 83% reduction by 2050.**

The wedge analysis:

- Is based on the City's current community GHG emissions inventory.
- Is based on best estimates of what's possible given current and anticipated technologies, policies, programs, and human behavior.
- Does not take costs of actions into consideration (i.e., assumes that the City will find and commit funding to the action).
- Accounts for interactions among strategies and actions.
- Includes consideration of future climate change impacts on heating and cooling energy use.

Caption: Wedge analysis of Columbia's communitywide GHG emissions, depicting potential emission reductions from identified strategies as compared to a business-as-usual scenario (by sector).

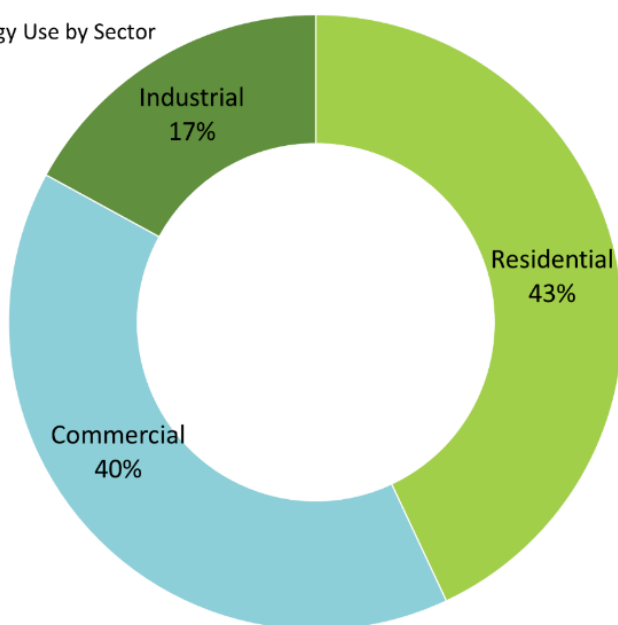


Energy

Energy refers to electricity generated and delivered to the Columbia community. Energy consumption accounts for 70% of Columbia's total greenhouse gas emissions and adopting clean energy is by far the most impactful modeled CAAP strategy. Energy-related emissions come from electricity used in homes, businesses, and in industry. Columbia's electricity is the primary factor in energy emissions, which means adopting clean energy has a big impact on community GHG emissions.

Climate change will impact energy use in Columbia. As air temperatures rise in Columbia, the use of air conditioning may increase, leading to increased energy use, household cooling costs, and greenhouse gas emissions. Households with lower annual incomes may be less likely to have air conditioning or may be more affected by increased energy costs.

Energy Use by Sector
2015



Strategies and Actions

This sector includes strategies for increasing renewable energy generation, managing energy demand, and increasing grid resilience. To increase renewable energy installation, the City can install solar panels on municipal buildings, streamline permitting for renewable energy, and support community solar programs. Adopting renewable energy can reduce energy costs and reduce air pollution associated with coal-produced electricity.

Columbia Water and Light can support CAAP goals by purchasing and producing renewable energy, and moving towards 100% renewable electricity generation.

Increasing grid resilience helps support the

City's energy supply in times of natural disaster and peak energy demand. For example, distributed energy storage can help smooth out the peaks and valleys of renewable energy sources like wind and solar and improve community capacity to maintain electricity with regional outages. Additionally, behavior change can help the utility manage peak demand during the hottest parts of the summer. Reducing peak demand helps the utility and ratepayers save money and prevent outages.

Throughout this, and every sector, education and outreach will play a critically important role. City staff, the Task Force, and community members noted frequently during this process that the programs, policies, and changes needed to meet the CAAP goals can only be valuable if people know they exist, why they are helpful, and how to access them. The Plan, in implementation strategy I-3.3: "Develop community leadership capacity for, and involvement in, climate action," prioritizes this crucial strategy to ensure education and outreach will be a part of its successful implementation.

Goal E-1. Increase local renewable energy generation and procure renewable electricity.

Strategy E-1.1: Increase on-site renewable energy installations in new and existing buildings.		
E-1.1.1	Offer community solar program through W&L.	Priority
E-1.1.2	Develop and implement virtual/aggregate net metering policies and procedures with W&L to allow privately developed community solar.	Priority
E-1.1.3	Install solar panels on all City buildings and sites, where feasible.	Priority
E-1.1.4	Streamline and offer expedited permitting for renewable energy installations.	Priority
E-1.1.5	Make it easier for large commercial and industrial customers to maximize the benefit of using their space for photovoltaics (e.g., feed-in tariff, third-party lease agreements, roof space rental).	Priority
E-1.1.6	Require production meters on all new net-metered photovoltaic installations.	Priority
E-1.1.7	Determine the true value and potential of customer-owned photovoltaics to the infrastructure, economics, and renewable goals of W&L. Analysis should include time of generation, capacity credit, distribution circuit support, customer characteristics, technical and market potential, etc.	Priority
E-1.1.8	Require all new commercial buildings to be solar ready.	Other
E-1.1.9	Permit lease program for photovoltaic on buildings connected via net metering open to CW&L and third party vendors.	Other
Strategy E-1.2: Maximize Columbia Water and Light's renewable energy purchasing and production.		
E-1.2.1	Include CAAP priorities in Columbia Water & Light's long range electric planning goals.	Priority
E-1.2.2	Consider all renewable energy sources on a cost per metric ton of CO2 equivalent basis reduction in the City's integrated electric resource plan.	Priority
E-1.2.3	Invest in local solar and wind fields.	Other
Strategy E-1.3: Revisit and adjust Columbia's Renewable Energy Ordinance to meet climate goals.		
E-1.3.1	Remove 3% rate cap to allow for increased investment by Water & Light in renewable energy resources.	Priority
E-1.3.2	Codify through ordinance Columbia Water & Light's responsibility to meet 100% renewable energy generation or purchase by 2035, including parameters for the use of Renewable Energy Credits (RECs) and equity and cost impacts.	Priority

Goal E-2. Maintain reliability of local energy supply and local distribution.

Strategy E-2.1: Create a resilient energy grid.		
E-2.1.1	Develop energy storage (battery) programs for all customer types to reduce peak demand, support electric grid reliability and improve the effectiveness of solar and other renewable energy options.	Priority
E-2.1.2	Ensure equitable implementation of grid resilience actions by partnering with vulnerable neighborhoods and non-governmental organizations to develop resilience hubs--community facilities that offer power and other community services during times of need. Establish criteria to screen and select locations for community microgrids to support grid and community resilience.	Priority
E-2.1.3	Maintain current rate of reliability due to weather related power outages. Investigate energy storage possibilities, such as batteries, to increase reliability.	Other
Strategy E-2.2: Manage energy demand to reduce peak energy use.		
E-2.2.1	Install meters that allow for rate structures that incentivize lower electricity use at peak hours.	Priority
E-2.2.2	Increase, enhance and implement demand side management programs.	Other
E-2.2.3	Implement utility scale energy storage.	Other

Housing, Buildings, Development

Housing and buildings can be designed to maximize energy efficiency and reduce the consumption of electricity and natural gas. These emissions come from residential, commercial, and industrial buildings consuming electricity and burning natural gas. Designing buildings to maximize efficiency and upgrading appliances can reduce these emissions and save money.

Climate change will impact housing, buildings, and development as warmer temperatures increase cooling costs and heavier rains increase the risk of local flooding. Flooding could damage infrastructure and limit mobility for neighborhoods in flood-prone areas of the city. The City's current stormwater infrastructure may not be able to handle the amount of runoff that is expected in the future as heavier rainstorms occur more often.

Strategies and Actions

Improving energy efficiency in the built environment and managing energy demand has social and economic benefits. Strategies focus on increasing energy efficiency support through incentives, requirements, and energy performance ratings. Supporting energy efficiency for low-income residents through rebates and landlord requirements will help tenants spend less money on energy and reduce greenhouse gas emissions. Columbia Water & Light Utility Services has the opportunity to manage programs that incentivize efficient appliances and reduce peak demand. Additionally, building energy use disclosures can drive energy efficiency improvements. By monitoring their energy usage, commercial, industrial, and residential buildings can identify opportunities for energy savings. Strategies focus on reducing energy use across all sectors through monitoring, building upgrades, and behavior change.

These programs will require training programs for professionals (e.g. contractors, designers, landlords, realtors, etc.) in the built environment to be developed and implemented. Education and outreach will help show the impact of the built environment on a larger scale. Educational opportunities for residents will also be provided so that smart, sustainable choices can begin at home.

Columbia will work towards achieving zero-emissions buildings and increasing climate resilience. The City can develop policies and incentives that phase in electric appliances as the City adopts clean energy. Supporting development of buildings that can withstand projected weather changes through code updates will help new buildings be resilient to climate changes.

Goal H-1. Reduce housing-, building-, and development-related energy consumption and improve resiliency.

Strategy H-1.1: Increase energy efficiency in residential buildings.		
H-1.1.1	Promote and offer incentives for improving residential energy efficiency during retrofit projects that exceed existing building energy code requirements. For example, using higher performance insulation materials in order to meet new construction energy code standards.	Priority
H-1.1.2	Increase energy efficiency funding options for income-qualified families (low-interest financing, on-bill financing, Pay As You Save, PACE, etc.).	Priority
H-1.1.3	Establish a date by which all rental housing will be required to meet basic energy efficiency standards at license renewal.	Priority
H-1.1.4	Develop and test an energy performance rating/labelling program for homes listed for sale or upon rental license renewal.	Priority
H-1.1.5	Phase in Zero Net Energy or highly energy efficient building requirements into the building code.	Other
H-1.1.6	Develop standard "deep retrofit" specifications and incentives for existing residential building owners to reduce the carbon footprint of the building to zero.	Other
H-1.1.7	Promote and offer incentives for improving residential energy efficiency in new construction (e.g., insulation, energy-efficient windows, electric heat pumps). New construction incentives shall support measures for projects that exceed code requirements.	Other
H-1.1.8	Formalize a Community Cost Share Fund for tax advantaged donations to go towards energy efficiency education and improvements for renters. Track with event attendance and participation in rental efficiency improvements.	Other
Strategy H-1.2: Increase energy efficiency in commercial buildings.		
H-1.2.1	Provide assistance to commercial buildings above a minimum gross floor area to track energy and water usage. Require all such commercial buildings to disclose their energy and water use.	Priority
H-1.2.2	Develop specific energy efficiency programs for hard-to-reach segments of commercial properties (e.g., commercial rental, restaurants, large scale manufacturing, offices, multi-family housing).	Priority
H-1.2.3	Promote and offer incentives for improving energy efficiency (e.g., insulation, energy-efficient windows, electric heat pumps) in newly constructed commercial properties. New construction incentives shall support measures for projects that exceed code requirements.	Priority
H-1.2.4	Identify funding strategies to ensure rebate budgets are sufficient to meet expanded offers and goals.	Priority
H-1.2.5	Create W&L Utility Services rebate programs that provide incentives based on energy use reduction in addition to demand reduction (e.g., lighting controls, outdoor lighting, energy recovery ventilation, CO ₂ controls, custom rebate).	Other
H-1.2.6	Require newly constructed buildings larger than 15,000 square feet to meet LEED Gold, Enterprise Green Communities, the 24 National Green Building Standard ICC/ASHRAE 700, or an equivalent certification.	Other
H-1.2.7	Require existing buildings larger than 15,000 square feet and exceeding minimum alteration thresholds to meet building certification of LEED Silver, Enterprise Green Communities, the 27 National Green Building Standard ICC/ASHRAE 700, or an equivalent certification.	Other
H-1.2.8	Develop "deep retrofit" standard requirements and incentives for owners of existing commercial buildings less than 15,000 square feet to reduce the carbon footprint of the building to zero.	Other

Strategy H-1.3: Increase energy efficiency in municipal and school buildings.		
H-1.3.1	Create a policy that all City buildings shall reduce energy usage by 20% over the next five years.	Priority
H-1.3.2	Create a policy, to be part of assigned duties and presented during new employee orientation that City employees shall turn off lights and equipment when they are done using them.	Priority
H-1.3.3	Introduce a policy that requires all new and existing municipal buildings to meet and maintain energy and resource efficiency standards (ENERGY STAR, LEED, HES or other).	Priority
H-1.3.4	Introduce a policy that requires all municipal buildings to be benchmarked with the current ES rating, the energy use intensity (kBtu/sqft) and the energy reduction goal. These benchmarks and goals shall also be posted on the City's website.	Priority
H-1.3.5	Create a target of net zero energy use at all municipal buildings by 2025.	Other
H-1.3.6	Work with school districts to support energy efficiency programs, geothermal energy, and solar energy installation.	Other
Strategy H-1.4: Decrease the impact of building stock on local air pollution and greenhouse gas emissions.		
H-1.4.1	Require that the City adopts the International Building and the International Energy Conservation Codes for municipal, commercial and residential buildings as written.	Priority
H-1.4.2	Improve training, certification and education opportunities for professionals involved in the disposal and use of refrigerants.	Other
H-1.4.3	Require, when cost comparable, that new air conditioning units use refrigerants with low global warming potentials (e.g., carbon dioxide or ammonia instead of hydrofluorocarbons).	Other
H-1.4.4	Develop incentive programs to transition lawn care companies and homeowners from using fuel-burning lawn equipment (e.g., lawn mowers, blowers) to electric.	Other
Strategy H-1.5: Decrease use of fossil fuels in housing and other buildings.		
H-1.5.1	Incentivize switching space and water heating from fossil fuel-based to electric heat pumps.	Priority
H-1.5.2	Invest in district heating and cooling for downtown City and County buildings.	Other
Strategy H-1.6: Support development of buildings that are resilient to anticipated future conditions.		
H-1.6.1	Require light colored roofs and/or a minimum specified reflectance for commercial roofs when new or at replacement.	Other
H-1.6.2	Develop affordable and efficient (temporary/transitional) housing options.	Other
H-1.6.3	Introduce a policy that limits new construction in the 500-year flood zone and/or requires infrastructure to be elevated two feet above anticipated flood level (no infrastructure equipment in lowest level).	Other

Transportation

Transportation refers to the form and function of transportation systems, including private vehicles, public transportation, and walking and biking infrastructure. Transportation made up 27% of Columbia's greenhouse gas inventory in 2015. Local, on-road transportation of passengers in privately-owned vehicles account for the majority of these emissions in Columbia.

Climate change may lead to more intense rain events and flooding, affecting road conditions in Columbia. Floods could temporarily block roadways and trails. Warmer temperatures and extreme heat may weaken pavement and require more maintenance. On the other hand, warmer winters may mean fewer instances of freezing and thawing and therefore less demand for other types of maintenance. Columbia residents who rely on walking or biking may be more exposed to extreme heat and poor air quality.

Strategies and Actions

Expanding public transit and building bicycle and pedestrian infrastructure will help reduce greenhouse gas emissions by reducing reliance on personal vehicles for transportation. This includes funding public transit expansion and prioritizing walking and biking infrastructure. Implementing the City's Vision Zero plan will be important for success.

Building sidewalks, bike-lanes, crosswalks, and other infrastructure can fill-in connectivity gaps identified in City plans. Additionally, creating walkable communities through mixed-used development and infill can connect neighborhoods to schools, community centers, and local businesses. This will help reduce the distance people need to travel to meet basic needs.

When people do need to travel in vehicles, Columbia can help encourage low emissions vehicles. Within the City's own operations, GoCOMO, Columbia's transit system uses 9 electric buses. City fleets can add electric and hybrid vehicles and the City can encourage private adoption of zero-emission vehicles by increasing the number of electric charging stations in public parking areas.

All of the transportation strategies and actions require the City to play a bigger role in advocating for the use of multi-modal transportation to get about Columbia. Efforts to change the public perception of traveling any other way than by personal vehicle is needed to achieve success in reducing transportation emissions.

Goal T-1. Reduce travel by car.

Strategy T-1.1: Prioritize safety and convenience of walking, biking, and riding transit.		
T-1.1.1	Prioritize transportation funding for Vision Zero engineering improvement projects to create safe streets for people walking, biking, and riding transit.	Priority
T-1.1.2	Revise street design standards that prioritize people walking, biking, and riding transit while also accommodating vehicles.	Priority
T-1.1.3	Prioritize transportation funding to achieve mode share goals.	Priority
Strategy T-1.2: Build a thriving public transit system.		
T-1.2.1	Improve efficiency, convenience, and reliability of bus service and infrastructure (e.g., increase frequency, shorten wait times, construct bus stop shelters).	Priority
Strategy T-1.3: Create a bikeable community.		
T-1.3.1	Build and maintain a network of on-street protected bike lanes on streets with speed limits above 30 mph. Build other bike facilities (bike boulevards, etc.) on streets with lower traffic/speed.	Priority
T-1.3.2	Establish a bike share program.	Other
Strategy T-1.4: Create a walkable community.		
T-1.4.1	Accelerate building sidewalks, crosswalks, and other walking infrastructure in high-need areas and to fill connectivity gaps as identified in Sidewalk Master Plan.	Priority
T-1.4.2	Install universal design accessibility features at crossing locations to ensure the crossing is accessible for everyone (e.g., pedestrian traffic signals, audible signals).	Priority
Strategy T-1.5: Shift land use patterns to shorten trips and reduce the need to drive.		
T-1.5.1	Revise zoning codes to favor walkable, connected neighborhoods in the existing built environment, near schools, and new development.	Priority
T-1.5.2	Incentivize infill and mixed-use development (e.g., through alternative code compliance, fee waivers, density bonuses, investment prioritization, development impact fees, tax benefits).	Priority
T-1.5.3	Revise zoning codes to encourage Accessory Dwelling Units (i.e., mother-in-law units).	Priority
T-1.5.4	Preserve and enhance affordable housing as well as infill development, especially near bus service.	Priority
T-1.5.5	Partner with Columbia Public Schools to adjust school siting requirements to prioritize building schools in walkable and bikeable areas.	Other
T-1.5.6	Eliminate downtown parking minimums and reduce surface parking while requiring new developments to invest in centralized parking.	Other

Goal T-2. Reduce greenhouse gas emissions from vehicles.

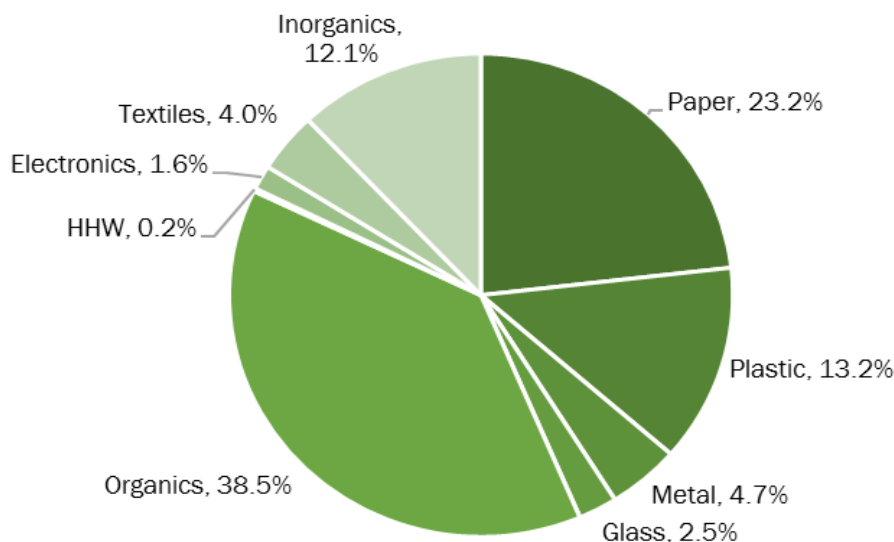
Strategy T-2.1: Encourage use of low- to zero-emissions vehicles.		
T-2.1.1	Introduce a policy to replace City fleet vehicles and buses with electric and hybrid options at time of replacement, and require emissions standards, testing and biofuel preference for any combustion vehicles remaining in the fleet.	Priority
T-2.1.2	Create EV roadmap to increase number of electric charging stations in public parking areas (e.g., schools, parks, libraries, city-owned parking garages, near city hall) and in commercial and high-density residential areas	Priority
T-2.1.3	Encourage installation of EV charging capacity in single family and multifamily residences (e.g., how to address residences that lack garage access).	Priority
T-2.1.4	Incentivize purchase of electric vehicles through rebates on vehicles and/or residential chargers.	Other
Strategy T-2.2: Reduce use and ownership of personal vehicles.		
T-2.2.1	Solicit a car share program, such as Zipcar or Get Around, to provide cars in a central location.	Other
T-2.2.2	Identify locations and partners to facilitate carpooling, telecommuting options, and parking buyback programs for municipal and other employers in the region.	Other
Strategy T-2.3: Improve efficiency of vehicle traffic.		
T-2.3.1	Implement street design to improve road and vehicle efficiency (e.g., roundabouts, synchronize traffic signals, road diets).	Other

Waste

Solid waste refers to the things we throw away or waste. When waste goes to landfills, it breaks down and generates greenhouse gases. Greenhouse gas emissions from the disposal of solid waste contributed 2% to Columbia's 2015 inventory. There are opportunities to reduce emissions associated with various parts of the lifecycle of goods and services, including manufacturing, use, and disposal. Overall, reducing consumption is the most effective way to reduce waste. For waste that is generated, diverting materials to recycling or compost can reduce remaining emissions.

Although not measured in the City's greenhouse gas inventory, consuming goods carries a significant carbon footprint—notably from meat consumption, home construction, and the purchase of furniture, clothing, and vehicles. Reducing material consumption, through green purchases, reuse, and repair, reduces consumption emissions.

Caption: The majority of waste generated by Columbia residents and businesses could be composted or recycled, as indicated by findings from the last statewide waste composition study (Source: MDNR 2016-2017 Statewide Waste Composition Study; data for Columbia Landfill; "inorganics" largely includes construction and demolition waste).



Strategies and Actions

Waste reduction strategies involve both behavior change and access to recycling and composting. Understanding the waste stream is essential to identifying opportunities to divert waste from the landfill, so strategies include regular waste characterization. To incentivize waste diversion, strategies focus on requiring all homes have access to recycling, construction and demolition waste is properly managed, and rates are structured to encourage recycling.

Reducing emissions associated with consumption and the lifecycle management of products include appropriately disposing of appliances using hydrofluorocarbons, reusing and repairing damaged appliances, and salvaging usable materials from demolition.

Promotional and instructional materials on how to reduce waste, reuse materials, and recycle goods will be needed to successfully implement the CAAP.

Goal W-1. Reduce waste generation.

Strategy W-1.1: Encourage reuse.		
W-1.1.1	Create a reuse program for curbside collection and purchase a warehouse to store and sell items that are not accepted by local non-profit groups.	Priority
W-1.1.2	Partner with Restore/Habitat for Humanity for demolition waste pickup and reuse.	Priority

Goal W-2. Increase diversion.

Strategy W-2.1: Reduce landfill waste through customer education, rate structures and increasing City recycling programs.		
W-2.1.1	Use roll carts for all single-family home solid waste services, excluding bulky item collection. Customers can pick the type and size of roll carts for their property, but they are only billed based on the size of their trash roll cart.	Priority
W-2.1.2	Restructure all solid waste rates to reduce the amount of waste sent to the landfill.	Priority
W-2.1.3	Require multi-family homes to offer on-site recycling for residents.	Priority
Strategy W-2.2: Expand composting participation and operation.		
W-2.2.1	Study the short and long term cost/benefit of a City composting program.	Priority
W-2.2.2	Offer 5 days/week (Monday through Friday) collection for food waste and certified compostable material at businesses. Change the type of compost operation or increase land allocation to handle additional feedstock, as needed.	Other
W-2.2.3	Offer compost roll carts and dumpsters to all residential properties (single-family and multi-family) for yard waste, food waste, and certified compostable products. This service is optional for all residential properties.	Other
Strategy W-2.3: Divert construction and demolition waste.		
W-2.3.1	Research management practices of construction and demolition waste diverted from the landfill.	Priority
W-2.3.2	Promote a C&D recycling industry in Columbia by preparing ordinance and construction permit changes that would be implemented if a C&D recycling company wishes to operate in the Columbia area. City staff will actively seek C&D recycling companies that might be interested in the Columbia area following the proposed policy changes.	Other
Strategy W-2.4: Require and incentivize recycling.		
W-2.4.1	Offer positive reinforcement and indirect financial incentives to encourage businesses and residents to divert material from the landfill.	Priority
W-2.4.2	Develop and enforce ordinances requiring commercial customers to recycle material streams like cardboard, paper, beverage containers, etc.	Priority
W-2.4.3	Offer quarterly curbside bulky-items pick up for residents and businesses.	Other

Goal W-3. Improve waste system management.

Strategy W-3.1: Encourage proper disposal of products containing high Global Warming Potential (GWP) gases.		
W-3.1.1	Research and add best practices for recycling hydrofluorocarbons (potent GHG used in refrigeration and air conditioning) in next CAAP update	Priority
Strategy W-3.2: Upgrade solid waste facilities.		
W-3.2.1	Remodel and upgrade the City's Material Recovery Facility to increase processing capacity, add sortation technology, and provide space for additional material types to be recycled, including (but not limited to) e-waste, mattresses, cartons, and household hazardous wastes.	Priority
W-3.2.2	Research new technologies for enhanced landfill methane capture.	Other
Strategy W-3.3: Track waste diversion.		
W-3.3.1	Conduct a comprehensive waste composition study every five years.	Priority

Health, Safety and Well-being

Health, safety, and well-being includes addressing impacts of climate change like heat stress, air quality and allergens, food security, vector-borne disease, and mental health. Climate change can disproportionately impact communities that are already at risk of harm, like low-income families, communities of color, the elderly and children, and homeless populations. For example, extreme heat can endanger people without shelter or without air conditioning. The City can prepare for climate impacts by investing in community resources and public health.

Strategies and Actions

To reduce negative climate impacts, strategies focus on addressing local air quality, food security, energy costs, and community resources. Many mitigation strategies have adaptation benefits. For example, warmer temperatures increase ground-level ozone, but efforts to minimize fossil fuel vehicle use can improve local air quality. Waste management strategies can also work synergistically with adaptation. As the climate changes, food production and therefore food sales may become more expensive. Preventing food waste through food donation can support multiple climate goals.

Preparing for extreme weather events can involve improving civic engagement and community resources. The City can promote neighborhood-led action, including preparedness training, involving the public in disaster planning, and creating community resilience centers.

Goal HS-1. Prepare the community, public safety and health services for anticipated climate change impacts.

Strategy HS-1.1: Include vulnerability assessments in planning efforts and enhance communication tools and strategies to prepare the community for anticipated climate change impacts.

HS-1.1.1	Develop and implement a plan to monitor climate change related illnesses. Utilize results in resource and policy planning, with particular focus on neighborhoods. Communicate results on a periodic basis to the public.	Priority
HS-1.1.2	Coordinate with community health improvement teams to incorporate climate change and CAAP goals into the Community Health Improvement Plan and Health Impact Assessment.	Priority
HS-1.1.3	Review and effectively communicate emergency and evacuation plans on a regular basis to update for climate change forecasted data, paying particular attention to flooding, extended heat waves, and tornadoes.	Priority
HS-1.1.4	Build City staff capacity to support community-led, neighborhood-focused resilience actions (e.g. identifying best practices, establishing resilience hubs, and implementing neighbor-based emergency response).	Priority
HS-1.1.5	Partner with outside agencies to offer community resilience model training.	Priority
HS-1.1.6	Conduct a needs assessment of accessible community centers for during extreme weather or other emergency situations. Create a development improvement plan, if needed.	Other
HS-1.1.7	Deploy point-in-time alert systems (e.g., RAVE, Nixle) to notify people of extreme weather events, periods of dangerous cold, and heat waves and refer them to resources on symptoms and prevention of climate-related illness.	Other
HS-1.1.8	Develop a long-term plan for potential growth in foreign and domestic refugees.	Other
HS-1.1.9	In planning for additional fire stations and resources, incorporate projections for increased grass, brush, and backyard fires.	Other

Strategy HS-1.2: Reduce incidences of heat-related illness and death.

HS-1.2.1	Identify a sustainable funding source for increased utility assistance for low-income residents, including support for energy efficiency projects such as weatherization.	Priority
HS-1.2.2	Increase availability to cooling mechanisms in low-income housing and rental units (e.g., air conditioning units, fans, window screens).	Other
HS-1.2.3	Develop a plan to improve bus stop shelters' ability to provide relief from extreme heat (reflective materials, cooling fans.)	Other
HS-1.2.4	Monitor number of utility disconnects during heat waves and assess if current policy should be updated for changing community needs.	Other

Strategy HS-1.3: Prevent and prepare for increased incidence of vector-borne diseases and illness or injury due to air and water quality issues.

HS-1.3.1	Create anti-idling policies and enforcement plans.	Priority
HS-1.3.2	Update property maintenance code to manage and mitigate mold or fungus.	Priority
HS-1.3.3	Establish funding and a program for trapping mosquitoes and ticks to monitor for disease or disease-carrying species.	Other
HS-1.3.4	Expand outdoor treatment to mitigate spread of vector-borne diseases when evidence of local disease is identified.	Other
HS-1.3.5	Identify sources of ozone pollution in Boone County and establish a county-wide system to gather and set thresholds to trigger actions.	Other
HS-1.3.6	Conduct a health impact assessment for areas that may have unsafe levels of air pollution from vehicle traffic, and use data to modify zoning.	Other

Strategy HS-1.4: Plan for a potential increase in demand for mental health care.		
HS-1.4.1	Form a team to develop action plans to address climate-related mental health resilience at the individual, neighborhood, and community level.	Priority
HS-1.4.2	Ensure community has robust resources to address increases in violence and crime, particularly domestic violence, during periods of stress including emergencies and heat waves.	Other

Goal HS-2. Reduce emissions associated with the food system.

Strategy HS-2.1: Increase production of local food.		
HS-2.1.1	Support organizations and schools promoting local food production and community gardens, through partnerships, funding, and educational programs including the benefits of a plant-based diet.	Priority
HS-2.1.2	Review ordinances and development regulations to promote urban farming.	Other
HS-2.1.3	Work with Regional Economic Development, Inc (REDI) to develop entrepreneurship program for commercial urban farming.	Other
HS-2.1.4	Update code to provide incentives or require developers to preserve topsoil and provide space for backyard or community gardens.	Other
Strategy HS-2.2: Assure food security, particularly among the most vulnerable populations.		
HS-2.2.1	Continue to provide enrollment assistance for participation in the Supplemental Nutrition Assistance Program (SNAP), the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) Program, and other food assistance programs.	Priority

Natural Resources

Natural resources refers to street trees, natural areas, and biodiversity conservation as well as water quality and supply. Climate change may increase heavy precipitation, lead to extreme heat, and shift the life cycle timing of our natural ecosystems. Maintaining and enhancing natural resources can increase natural resilience to climate impacts.

Strategies and Actions

Strategies include supporting urban forests and greenspace. Urban forests and tree management can help cool homes and businesses during extreme heat events. Greenspace supports wildlife, stormwater management, and recreation. Strategies focus on protecting and managing open space as climate change alters ecosystems. Conserving water is also a key way to protect natural resources. The City can update building codes, focus on incentivizing water conserving appliances, and manage roadside vegetation to increase stormwater absorption.

Actions that protect and conserve biodiversity will create a more resilient Columbia. These actions will be supported by educating the community about the benefits of nature in our city and how to incorporate it into their everyday lives through sustainable landscaping, design, and stewardship.

Goal NR-1. Increase climate resilience and carbon sequestration potential of public and private lands.

Strategy NR-1.1: Increase the accessibility and quality of habitat for native plants and animals.

NR-1.1.1	Manage publicly-owned natural areas to enhance and maintain diverse native communities.	Priority
NR-1.1.2	Establish and effectively manage native habitat corridors along trails and utility easement areas to restore and maintain landscape connectivity.	Priority
NR-1.1.3	Create an ordinance that establishes a Transfer of Development Rights program to protect undeveloped lands for land conservation and/or agriculture.	Priority
NR-1.1.4	Support the Urban Forest Master Plan to identify programs and suitable locations to maintain and expand Columbia's urban tree canopy.	Priority
NR-1.1.5	Update current tree preservation requirements to protect tree root systems and large legacy trees during construction.	Priority
NR-1.1.6	Assess whether or not to purchase and preserve greenspace in and surrounding the city by quantifying the equitable, environmental, and economic benefits along with the costs of maintaining and owning the property.	Other
NR-1.1.7	Require the use of climate-adapted plants in landscaping at City-owned properties.	Other
NR-1.1.8	Update current development regulations to recommend or require the use of appropriate climate-adapted trees and plants for new- and re- development.	Other
NR-1.1.9	Identify underutilized paved areas and incentivize conversion to sustainable green space.	Other

Goal NR-2. Reduce per capita water usage.

Strategy NR-2.1: Encourage water conservation.

NR-2.1.1	Update rate structure to encourage reduced water use.	Priority
NR-2.1.2	Update building code to require water conservation measures (e.g., grey water infrastructure, drought resistant landscaping) in new construction and renovations.	Other
NR-2.1.3	Develop a technical assistance and incentive program to encourage water conservation behavior and upgrades, such as use of drip irrigation and low-flow toilets.	Other

Goal NR-3. Reduce negative impacts from stormwater runoff and flooding.

Strategy NR-3.1: Improve stormwater management.

NR-3.1.1	Implement strategies to mitigate stormwater impacts due to development and redevelopment of properties currently exempted from stormwater management requirements.	Priority
NR-3.1.2	Build more permeable parking lots and driveways and use more recycled materials with concrete.	Other

Strategy NR-3.2: Minimize risks to flood-prone areas.

NR-3.2.1	Mine existing data sources (e.g., FEMA Risk Maps) to identify areas prone to flooding.	Priority
NR-3.2.2	Perform detailed studies to identify areas that are at high risk for flooding and may be prospect for property acquisition or mitigation.	Priority
NR-3.2.3	Increase stream buffer requirements to provide additional flood water storage and minimize property damage due to erosion and flooding.	Priority
NR-3.2.4	Perform a flood risk assessment using historical data and future precipitation forecasts to identify areas and critical infrastructure vulnerable to flooding.	Priority